MONOGRAPH.

Art. XII.—*On the Thymus Gland; its morbid affections, and the diseases which arise from its abnormal enlargement.* By Charles A. Lee, M. D., of New York.

The *Thymus Gland* has of late attracted considerable attention among pathologists, from the circumstance that its enlargement has been supposed to give rise to a peculiar train of symptoms, often terminating fatally, and sufficiently unique as to constitute one or more distinct diseases. A sufficient number of these cases has now been recorded, both in the foreign and domestic medical journals of the day, to enable us to arrive at some definite conclusion as to the reality of such affections; and it is our purpose in the present Essay, to pass these cases in review, and weigh, with due impartiality, all the facts which have any important bearing on the subject.

Before proceeding to do this, it will be proper to premise a few remarks in relation to the anatomical structure and physiology of this organ, as a knowledge of these necessarily lies at the foundation of all correct pathology of its morbid conditions.

Anatomy.—The thymus gland, according to Sir Astley Cooper, whose description we shall chiefly follow, is formed of a thoracic and cervical portion on each side. The former is situated in the anterior mediastinum, and the latter is placed in the neck just above the first bone of the sternum, and behind the sterno-hyoidei and sterno-thyroidei muscles. At the second month of fœtal life it is just perceptible, but at the third month its increase is in proportion to the relative magnitude of the fœtus, and thus it continues to grow gradually and equally to the seventh month, when it enlarges out of proportion to its former growth. At eight months it is large, but at the ninth month it has undergone a sudden change, and becomes of great size, "from which circumstance," says Sir Astley, "on account of the cavities which it contains, and the varieties to which it is subject, no judgment of its bulk can be formed."

Relative situation.—The thymus gland then, is situated directly behind the first, and part of the second bone of the sternum, and posteriorly to the origins of the sterno-hyoidei and thyroidei muscles, reaching more than half way down the sternum at birth, viz. to the fourth rib, and extends from thence into the neck near to the thyroid gland. It is connected to the above named muscles by cellular tissue, and adheres strongly to the pericardium anteriorly, by a coarse cellular membrane, and laterally the internal mammary arteries and veins take their course. According to Cooper, and we have often verified this by our own dissections, the reflection of the pleura, descending from the cartilages of the ribs on each side and continued to the fore part of the pericardium forming the anterior mediastinum, makes its lateral boundaries, and separates it from the lungs; while posteriorly it rests upon the vena innominata, and upon the fascia of the thorax, which descends from the sternum and first rib to the curvature of the aorta and to the three large vessels which spring from it, viz. the arteria innominata, the left carotid and left subclavian arteries. It thus lies on the fore part of the trachea, and is connected to the larynx by a ligament, while the internal jugular veins are situated anteriorly and laterally to the cervical portion of the gland, and the carotid arteries with the par vagum appear more externally. According to Haugsted, the upper lobe lies over the left subclavian vein, with which it is loosely connected; the inferior lobe adheres to the pericardium, while the *lobulus*, which looks like a lymphatic ganglion, adheres to the right subclavian artery for the extent of about two lines.

Intimate structure.—The thymus gland is extremely delicate in its texture—of a very soft and pulpy nature, and is composed of a large number of minute lobules, the largest of which is about the size of a pea, and the smallest that of a pin's head. These little lobes are connected together by cellular membrane, and are disposed in a serpentine direction around a cavity, and when unravelled resemble a string of beads. The gland seems composed of numerous secretory cavities or cells, which open into a pouch leading to a reservoir, so that the secretion which escapes from the lobes finds a ready entrance into the cavity of the gland, from which it may be absorbed. This reservoir is represented as forming a general communication between the different lobes, beginning from the inferior part of the thoracic portion and extending into the extremity of the cervical. It is lined by a membrane, apparently of a mucous character, villous rather than smooth, and highly vascular. Its interior forms ridges, which are produced by small ligamentous bands, which cross the surface of the reservoir in various directions, and encircle the mouths of the pouches. "These bands," says Cooper, "are formed for the purpose of keeping the lobes together, of preventing an injurious yielding of the parietes of the cavity, and to give strength to resist too great an accumulation of the secretion. When the reservoir is floated in water, a number of small openings appear upon its internal surface, and if a probe be introduced into these, it passes into the pouch at the roots of the lobes, so that by these apertures, the secreted fluid escapes into the reservoir."* These orifices are not so numerous as the lobes themselves, the reason for which is, that each pouch communicates with more than one lobe. The entire gland may be represented as composed of numerous secretory cells, communicating with each other, and opening into the pouch of the lobes, and from the pouch into the reservoir.

Arteries of the Thymus.—These are chiefly derived from two sources. First, each thoracic portion is supplied by a branch sent off by the internal mammary artery, which enters at the juncture of the cervical with the thoracic part, generally on their outer side, but sometimes between the cervical portions, and descending upon the middle of the gland, divides to supply the spirally disposed lobes. The vessel thus passes to the inner side of the reservoir, and is distributed to its mucous membrane on the one hand, and its glandular structure on the other. Secondly, it is supplied by a branch from the superior and sometimes from the inferior thyroidal artery, which descends upon the lobes of the cervical portion, passes into them, and to the membrane of the cavity which they contain, and ultimately, anastomoses with the branch from the mammary artery. These arteries serve not only to supply the gland with blood, but also to combine the lobes together and prevent their separation.

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* "The Anatomy of the Thymus Gland. By Sir Astley Cooper. London, 1838, p. 30.

Veins of the Thymus.—A vein springs from each thoracic portion of the gland, and passes along the posterior surface into the vena innominata. Small veins also pass from it into the internal mammary and thyroideal veins.—Its *nerves* are so small that they can be traced with difficulty. The superior thoracic ganglion of the sympathetic, gives off a twig which forms a plexus around the internal mammary artery, and on the superior cava, with which some filaments of the phrenic nerve communicate. From this source the thymus gland doubtless receives its supply, although the twigs are too minute to be demonstrated.

Physiology of the Thymus.—This is involved in considerable obscurity, although it is generally admitted by physiologists that the gland is destined to perform an office connected with the fœtal, and the early stages of infantile existence. It is known to secrete a great abundance of white fluid, similar to chyle; 100 parts of which yield, on analysis, 16 parts of solid matter, composed of incipient fibrin and albumen, besides a quantity of mucus, and muco-extractive matter. When examined under the microscope, the fluid is found to contain an immense number of white particles; so that it appears to secrete all the component parts of the blood, viz.: albumen, fibrin, and particles, although they are destitute of the colouring principle. It is therefore highly probable, as Cooper has suggested, that the gland is designed to prepare a fluid fitted for the fœtal growth and nourishment from the blood of the mother before the birth of the fœtus, and consequently before chyle is formed from food, and that this process continues for a short time after birth, the quantity of fluid secreted gradually declining as that of chylification becomes perfectly established. When we consider in connection, that where the *foramen ovale* remains open, or there is any uncommon obstruction of a chronic character in the circulation from any cause whatever, the thymus is always found enlarged, we shall be confirmed still more in the opinion that its function is closely connected with hematosis, as well as chylification.

Weight and size of the Thymus.—According to Haugsted, Sir Astley Cooper, Meckel, Cloquet, Müller, and Horner, the weight of the thymus gland at birth, averages about 240 grains, or half an ounce. Meckel states that it often weighs 300 grains in a large fœtus, born at the full period. The reviewer of Haugsted's paper in the *Medico-Chirurgical Review* for Ap. 1834, gives the weight of the gland at birth, between two and three drachms, or varying from 120 to 180 grains. Meckel remarks that it increases in size till the end of the first and sometimes to the end of the second year in the same proportion as in the full grown fœtus. If this be true, allowing its normal weight at birth to be 200 grains, and the commencement of its growth at the third fœtal month, its weight at the end of the first year would be 536 grains, or 648 grains, if it weighed 240 grains at birth; gaining in the former 28, and in the latter 34 grains per month. This is evidently, however, an over estimate. Hewson describes the gland as continuing to grow to the end of the first year after birth, while from the first to the third year, it is neither perceptibly increased nor diminished; but from the third to the eighth or tenth year it decreases in size, and gradually wastes away to the tenth or twelfth year, when, ordinarily, he remarks it is effaced, having only ligamentous remains that degenerate into a kind of reticular substance. The same writer states that he never saw a case where the thymus gland existed at the time of puberty. Cloquet, Meckel, Müller and others, give nearly the same account of its growth and disappearance. In opposition, however, to this, we have the authority of Dr. Krause, who states that he has found the thymus in almost all individuals between 20 or 30 years of age, and very often larger than in young children; and that he has seen it of considerable size between the ages of 30 and 50, and has met with the brownish red remnants of it still later in life.* The following is his measurement of the gland in some very healthy and well-made individuals who had committed suicide.

Age & Sex.	Length.	Breadth.	Thickness.	Weight.	Volume.	Spec. Grav.
25—M.	34 lines.	18.25 lines.	4. lines.	292.5 grs.	0.977 c. inc's.	1.0352
25—M.	42 "	32. "	2.3 "	380.3 "	1.156 "	1.0311
20—M.				356.5 "	1.085 "	1.0309
28—F.	22 "	16. "	2. "	69.2 "	0.211 "	1.0267

The statement, therefore, that the thymus disappears after the 12th year is probably erroneous, though further observations are needed to set the question entirely at rest.

Dr. Roberts, of New York, has lately published the weight of six thymus glands, five of which were observed by himself, as follows:—

Age.	Length.	Breadth.	Thickness.	Weight.
1. Twin-fœtus born at full time.	1 inch.	1 inch.		161 grs.
2. Twin-ditto.	$1\frac{8}{10}$ "	$1\frac{8}{10}$ "	5 lines.	129 "
3. Full grown fœtus.	$2\frac{2}{20}$ "	2 "		80 "
4. Full grown fœtus.	$2\frac{4}{10}$ "	$1\frac{8}{10}$ "		120 "
5. Five months.	$2\frac{3}{10}$ "	2 "	$\frac{4}{10}$ "	223 "
6. Full grown still-born fœtus.	2 "	$2\frac{1}{2}$ "	$\frac{7}{10}$ "	360 "

According to these results, the average weight of the gland in the full grown fœtus, is only 170 grains, which, it will be seen, is 70 grains less than is stated by anatomists generally. Rejecting however the twins, the average weight at the time of birth is 229 grains. If then we adopt Meckel's rule that the gland increases in weight during the first two years in proportion to the rest of the body, we have the following weights for the corresponding months.

At birth,	229 grs.	End of 7th month,	453 grs.
End of 1st month,	261 "	" 8th "	485 "
" 2d "	293 "	" 9th "	517 "
" 3d "	325 "	" 10th "	549 "
" 4th "	357 "	" 11th "	581 "
" 5th "	389 "	" 12th "	613 "
" 6th "	421 "	" 13th "	645 "

This would give nine hundred and ninety-seven grains as the weight at the end of the second year, or $2\frac{1}{2}$ ounces; a result not confirmed by observations hitherto made. All writers, however, agree that the gland continues to increase to the end of the first, and most of them to the end of the second year. In some cases we observe an appearance as if the gland had been compressed during the movements of respiration; but when we consider that its relative situation is such, that there is no obstacle to the expansion of its lobes backwards, we may well doubt whether this has actually been the case. Any person who has examined the thymus gland after the third or fourth year, must have observed that its cellular texture has become more close, its milky juice less abundant; and although abundantly supplied with blood-vessels, it evidently exercises little influence upon the rest of the system—although its absolute weight remains probably nearly stationary, yet its specific gravity sensibly diminishes. From 1.071, the sp. gr. at birth, Dr. Haugsted found it to have fallen, 14 days after birth to 1.02; and in a child of ten years of age, to be nearly as low as that of water. As soon as the permanent teeth make their appearance, the gland undergoes a sudden diminution in size; its blood-vessels shrink, and its cells become obliterated; its milky secretion disappears, its substance becomes absorbed, and its lobes thin and separate from each other. When it has altogether disappeared, its place is supplied by a fatty mass, including some brownish-coloured corpuscles.

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* Muller's Archiv. fur Anat. Physiol. und Wissent Medicin. Heft. 1, 1837.

Diseases of the Thymus.—This gland is subject to certain morbid conditions, such as *atrophy, hypertrophy, tubercular* and *scirrhous degeneration*, as well as ordinary inflammation. In some instances, the number of lobes is increased; but there are few cases on record where it has been found entirely wanting, or of extremely small dimensions, except in acephalous, or anencephalous monsters. That it is occasionally the seat of *tubercular* deposit, is admitted by most pathologists, though such cases are of rare occurrence. Dr. Gross states,* that he found numerous tubercles in the thymus of a phthisical child fifteen months old, of large size, and in a state of partial softening. The glandular structure immediately around them, was unusually hard, and of a deep red colour, from the great distension of its vessels. M. Cruveilhier states, that he has seen the thymus in a young infant filled with tubercles, in a state of suppuration, such as we observe in the lungs in the last stage of phthisis. M. Portal also remarks, that tubercles are often found in the thymus and anterior mediastinum, in rachitic children; and Lieutaud has recorded several instances of the same disease in adults, who had died of consumption or other pulmonary affections. Such cases are also recorded in Haller's "Disputations;" in one of which, a tubercular cavity in the thymus communicated with the trachea. This tubercular degeneration, which almost invariably occurs in scrofulous subjects, has often been mistaken for scirrhus. In most of these cases, the substance of the gland becomes very dense and solid, all traces of cells disappear, and when the disease has existed for some time, the thymus presents the appearance of a conglobate gland. We have been able to find but few, if any cases of the scirrhous degeneration of this organ on record. Examples of *calcareous* degeneration of the thymus are recorded by Vater, Harder, Hoffman, and others. Cases of *ossification* of the thymus are alluded to by Haugsted; but he thinks it doubtful whether a truly ossific deposit has ever been discovered in the substance of the thymus; dense concretions, such as those of a calcareous nature, having been mistaken for true ossification. Though there may be considerable difficulty in distinguishing between them, yet when we remember that in addition to its phosphate of lime, a bony deposit contains animal gelatine, which is never found in any calculus, and that all ossific formations are organized substances, nourished by their proper blood-vessels, and susceptible of absorption, which is not the case with calculous concretions, we shall be able without much difficulty to discriminate them.

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*Gross's Pathological Anatomy, vol. ii, p. 14.

The thymus is also subject to a degeneration of a *steatomatous* and *fungoid* character. A case of the latter description is recorded by Sir Astley Cooper, in his work already quoted. This occurred in a young lady nineteen years of age, who was subject to frequent attacks of dyspnœa, attended with a painful sense of suffocation. The swelling had existed for several years, but had latterly much increased. On dissection, the thymus was found of a yellowish white colour, filled with a white pulpy substance, divided into several large lobes, and extending from the curvature of the aorta to the lower part of the thyroid gland, the latter of which was also much enlarged. The symptoms were apparently produced by the pressure of the tumour upon the trachea, diminishing its transverse diameter. In the beginning of the last century, Cowper and Budœus recorded two cases of diseased thymus, in men who were about thirty years of age. In one of them the patient had laboured under dyspnœa from infancy, and at length died from suffocation. On dissection, the pulmonary parenchyma was found studded with tuberculous deposit; the thymus gland had acquired great size, was indurated, scirrhous and cartilaginous, in part resembling the texture of a scrofulous or steatomatous tumour; it adhered very strongly to the large vascular trunks, and occupied all the upper portion of the thoracic cavity.

Thymitis, or inflammation of the substance of the thymus, is a disease of very rare occurrence, and in no instance, as we are aware, has it been recognized during life, or even suspected before the death of the patient. Nevertheless, purulent collections have been discovered on dissection, in the substance of the gland, demonstrating the existence of previous phlegmasia. In the "Nosology" of Sauvages, are detailed the symptoms which this writer considered pathognomonic of this affection—such as a certain degree of impediment to deglutition and speech; vomiting after eating; dyspnœa, and tumefaction at the lower part of the neck. And Portal, in his edition of Lieutaud, mentions the case of a child, who died of convulsions, and where there was found on dissection, an effusion into the pleura and pericardium; the thymus being largely increased in volume, and containing a cyst full of blackish sanies. Haugsted, however, thinks that the far greater number of examples of suppuration occurring in the substance of the thymus, have been preceded by the existence of tuberculous matter, which at the same time is generally found in the lungs. Morbid affections of this gland, with the exception, perhaps, of hypertrophy, which we shall presently notice, must be regarded as of rare occurrence, since Sir Astley Cooper states, that in the course of more than forty years' experience, he had met but a single instance where it was in a diseased state; and Professor Mott, whose experience is scarcely less extensive, assures us that he has met with but a single example of a like kind. A case of distinct *thymitis* occurred several years since in our own practice, in which the gland suppurated and discharged externally.

Hypertrophy of the Thymus.—This morbid affection of the gland is supposed to be of rather frequent occurrence, at least compared with those above mentioned. It was noticed by Morgagni nearly two hundred years ago, and more than a century since by Richa and Verdries, as a cause of asthma in children. Allan Burns described this affection more than twenty years ago, and foreseeing that it might be a cause of serious disease, proposed to dissect it out, which Dr. Montgomery thinks would be a most decisive operation in the way of cure, for after its performance the infant would not be likely to be troubled with this or any other complaint. Mr. Hood gave a history of several cases of enlarged thymus, in the third volume of the *Edinburgh Journal of Medical Science*, (1826,) and offered some highly judicious remarks thereon. Professor Ecke reported a case of enlarged thymus in *Rust's Magazine* for 1825, where death resulted from suffocation. The attention of the profession was, however, particularly directed to this affection by Dr. Kopp, of Germany, who read a paper on *Thymic Asthma* at the annual meeting of scientific men at Heidelbergh, (1829,) which has since been published in a separate work.* Still later, Drs. Hirsch and Flachmann have written essays on the same subject.† In the *Dublin Journal of Medical Science*, (July, 1836,) there is a very able essay, by Dr. Montgomery, on *enlargement of the thymus*, in which he relates several cases of sudden death in children, supposed to be owing to this cause. In our own country, Dr. W. C. Roberts of New York, has published five cases which he considers to have been of a similar character.‡ In the cases whose history is given by Dr. R., the age, and weight of the gland were as follows—1st. Age 29 hours, weight 402 grains; 2d. 8 months, weight 330 grains; 3d. 8 months, 484 grains; 4th. 19 months, 175 grains; 5th. 2 years 8 months, 257 grains. In No. 2, vol. i, *New York Medical Gazette*, Dr. Hoffman relates a case of sudden death in a child ten months old, which he attributed to an enlarged thymus, which weighed 330 grains. In the 11th No. of the same Journal, a case is given by Dr. Hamilton of Rochester, where the gland was found to weigh 480 grains, or one ounce, in a child 9 months old, which died after a sudden attack of illness. In *Guy's Hospital Reports* for April, 1841, a case is detailed by Dr. H. B. Beck, where, in a child of 4 months, the gland was enormously enlarged, weighing, as was supposed, about an ounce. Dr. Swett of New York, has published two cases of a similar character, in the 2d volume of the *New York Medical and Surgical Journal*, but in these instances the gland was not weighed. In the instance of the child of Dr. S. P. White of N. York, 16 months old, the gland was six inches in length, and probably weighed about one ounce. The thymus has not only been found hypertrophied in children, but also in adults, and even in old people. In some of these cases, the suspected enlargement was in all probability a morbid growth occupying the site of the gland. Besides the case already quoted from Cowper, in which the large size of the thymus evidently presented a great impediment to the free dilatation of the lungs. Meckel has recorded the history of a soldier, 26 years of age, who had long suffered from paroxysms of dreadful anxiety and dyspnœa, which at first recurred at considerable intervals, but afterwards became much more frequent. In the upper part of the cavity of the anterior mediastinum, there existed two large lobes of the thymus, each of which was 3½ inches long, and from 6 to 10 lines in breadth, and their texture was nearly the same as in the fœtus. Tozetti§ has also recorded a remarkable case of hypertrophy of this organ. The patient, 50 years of age, had laboured during 20 years under occasional dyspnœa, the paroxysms of which had gradually grown more frequent, terminating in dropsy of the chest and abdomen. The thymus measured 4 inches in length, 3 in breadth, and 2 in thickness; and its weight amounted to *nine ounces*. The texture was more solid and fleshy looking than natural. Hufeland* has related a case of fatal angina pectoris, in which the only morbid lesion detected after death, was an enormous fatty-like enlargement of the thymus gland, which occupied the whole of the anterior mediastinum. A case of tuberculous degeneration of the thymus in a child 7 years of age, was treated in the hospital at Copenhagen, in 1830, where, on inspection, the gland was found to weigh 5 ounces.†

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* Denkwurdigkeiten in der artzlichen Praxis—Bd i, Frankfurt, 1830.

† See Dieffenbach's Zeitschrift, No. 7, 1837.

‡ American Journ. Med. Sciences for August, 1837, November, 1838, and Oct. 1841. New York Journal of Med and Surg., Jan. 1840. N. York Med. Gaz. July 21, 1841.

§ Raccalta di Opusculi Medico Practici, p. 75.

The above comprise a large proportion of the cases of enlarged thymus, (so called,) which have hitherto been published. In some of them, the reader will perceive that the weight of the gland is rather *below*, than *above*, the normal standard; and in several others it will be shown, that death in all probability resulted from other causes, while the engorgement of the thymus was the effect, rather than the cause of the morbid symptoms, which were doubtless occasioned by lesions of the circulatory or respiratory organs, or both.

Symptoms consequent upon hypertrophy of the Thymus.—From the situation of this gland, it has very naturally been supposed, that its morbid enlargement must offer considerable impediment to the function of respiration, not only from its pressure upon the trachea, but also upon the lungs, the great vessels, and the phrenic, pneumogastric and recurrent nerves. In confirmation of this opinion, reference has been made to a remark of Sir Astley Cooper, that, as the thymus is situated in the thoracic opening, in its enlarged state it soon reaches the sternum and first rib, by which it is bound, and therefore its increase is towards the trachea, which becomes enveloped by it, and its function interrupted in consequence of its compression. But it is to be remarked, that Sir Astley was speaking of cases where the structure of the gland had become dense, or the seat of scirrhous, tubercular, or calculous degeneration. He nowhere hints at the possibility of its occasioning serious symptoms, or any impediment to respiration, when in its natural soft and pulpy state, although in a condition of hypertrophy. Considering the spongy and highly distensible nature of this gland, and the cartilaginous, elastic structure of the trachea, with the exception of its posterior segment, against which we have no reason to believe the thymus ever presses, we should not believe, *a priori*, that the degree of hypertrophy recorded by the different writers on the subject, could possibly occasion the symptoms attributed to this cause. Another circumstance which renders such compression extremely improbable, is the fact, that when congested from any cause, it presses up through the superior aperture of the thorax, (for in its natural state its lower portion only lies behind the sternum,) and is seen forming a protuberance in the neck, covered merely by the integuments, and a thin layer of muscular substance. Besides, we have seen that it is composed of a mass of cells, surrounding a reservoir, and therefore little calculated in a normal state of its structure, even when enlarged to a considerable extent, to exert any great degree of compression upon the surrounding parts. We shall moreover see, that the anatomical position of the gland does not allow it to produce much pressure upon the air passages, the cornua being in those cases where it was greatly hypertrophied too short to reach the larynx, and the lateral lobes rarely pressing upon the trachea. Even in the case of Dr. Roberts,[*] where the gland weighed 484 grains, he remarks, that "the pressure exerted by the gland was chiefly within the chest, and by the lateral lobes upon the lungs and the heart. The cervical ones were short, and probably exerted little compression upon the nerves of respiration; neither was the trachea much pressed upon," &c. We shall recur to this point again shortly.

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* Journal of Practical Med. 1806.

† Med. Chirurg. Review, vol. xxi, p. 198.

Thymic Asthma.—An affection peculiar to early infancy, characterized chiefly by a periodical spasm of the glottis, larynx and lungs, and eventually extending to the whole cerebro-spinal system, has been noticed by many writers on diseases of children, particularly Marsh, (*Dublin Hospital Reports*, Vol. V,) who has described it under the name of *spasm of the glottis*; and Ley, who denominates it *Laryngismus Stridulus*, after Dr. Good. It has also been treated of by Kellie, Clarke,[†] Porter, Pretty, Newton, Richter, Robertson, Underwood, North, Millar, Jurine, Joy, Jolly, Guersent, Albers,[‡] and others. Millar calls it "*acute asthma*," and he describes it as attacking suddenly, often at night, like croup, particularly distinguished by paroxysms of suffocation, accompanied by a kind of croaking analogous to that observed in some hysteric attacks.[§] Underwood, Cullen, Albers, and Dr. Rush (at one period) considered the acute asthma of Millar to be *croup*. Jurine regarded it as *suffocating catarrh*; Joy as "*spasm of the glottis*;" Jolly and Guersent[‖] as "*nervous or convulsive asthma*," while Dr. Gooch designates it by the term "child crowing." In the *Edinburgh Med. Journal of Science*, for 1827, Dr. Hood first particularly called the attention of the profession to this disease, as sometimes resulting from enlargement of the thymus, and gave the history of several dissections going to prove the correctness of this theory. We have already alluded to the fact that Richa[¶] and Verdries,[**] who wrote more than a century ago, recognised hypertrophy of the thymus as the cause of asthma; and we read in P. Frank, "in asthmate, ut nominant puerilli, glandulas bronchiales preter sanitatis modum maxime vero *thymum insigniter tumefactione* invenerunt anatomici." It may, however, be said with truth, that no systematic attempt had been made to trace this disease exclusively to enlarged thymus, until the essay of Dr. Kopp appeared in 1830. From him it derived the name of *thymic asthma* or *Kopp's asthma*, which appellation it has continued to retain in Germany to the present time.

The chief symptoms of *thymic asthma*, as detailed by Kopp and Hirsch, are the following: The attacks generally come on in the night, when the child suddenly awakens with a peculiar piping cry, which resembles the suffocative inspiration of hooping-cough but is much shorter and more acute, and disappears again instantaneously. It is very similar to the choking attempts at inspiration made during the hysteric paroxysm. In some cases, there may be several whistling inspirations, and then a few deeper and stronger, alternating with expirations so slight as scarcely to be perceived. This peculiar cry is evidently owing to a contraction of the glottis, and is pathognomic of the affection consequent upon the suppressed respiration, the body is forcibly extended backwards, or the limbs drawn close up together, the face becomes purple or deadly, and indicative of great distress, while the eyes are fixed, the nostrils expanded, the hands cold, the thumbs contracted, and the whole body seems in a state of spasm.

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[*] American Journal Med. Sciences, August, 1837.

[†] Commentaries on Diseases of Children, edit. 1835, p. 41.

[‡] Commentaries de diagnosi Asthmatis Millari strictuis de finienda. Gottingen, 1817.

[§] Observations on the Asthma and on Hooping-Cough. London, 1769.

[‖] Asthme Aigu in Dict. de Med. Paris, 1821.

[¶] Constitutiones Epidemical Taurinensis, 1728.

[**] Disputatio de Asthmate Puerorum. Gless, 1726.

The paroxysm generally ceases after a period of half a minute or a minute: in some instances it lasts two or three minutes, when the child cries for a short time, and then becomes cheerful and quiet, as if nothing had happened. In some cases, where the constitution is very feeble, the child will remain languid and sleepy for some time. The attacks are not frequent at first, recurring only at intervals of several days, but they gradually increase in frequency until they come on ten or twelve, and even fifty times in a day. In this stage death often happens in the paroxysm, although the patient had but a short time before been in apparently perfect health. In a majority of cases, however, another stage succeeds before death, characterized by general convulsions of an epileptic kind: the convulsions either alternating with, or accompanying the asthmatic paroxyms. The child in these cases is carried off in a paroxysm, either with symptoms of apoplexy and suffocation, or suddenly without any affection of the chest or prolonged agony of any kind. Such in brief, are the symptoms of *thymic asthma* as recorded by Kopp and Hirsch.

Now if we compare this with the following description of a "peculiar species of convulsion in "infant children," as given by Dr. John Clarke, in his *Commentaries on Diseases of Children*, (p. 86, 90,) we shall find that they are the same identical disease. "This convulsive affection occurs by paroxyms, with longer or shorter intervals between them, and of longer or shorter duration in different cases, and in the same case at different times. It consists in a peculiar mode of inspiration which it is difficult accurately to describe. The child having had no apparent warning, is suddenly seized with a spasmodic inspiration, consisting of distinct attempts to fill the chest, between each of which a squeaking noise is often made: the eyes glare, and the child is evidently in great distress: the face and extremities, if the paroxysm continues long, become purple, the head is thrown backward, and the spine is often bent, as in opisthotonos; at length, a strong expiration takes place, a fit of crying generally succeeds and the child, evidently much exhausted, often falls asleep. In one of these attacks a child, sometimes, but not frequently, dies. They usually occur many times in the course of the day, and are often brought on by straining, by exercise, and by fretting; and sometimes they come on from no apparent cause. They very commonly took place after a full meal, and they often occur immediately upon waking from sleep, though, before the time of waking, the child had been lying in a most tranquil sleep. As the breathing is affected by these paroxyms, the complaint is generally referred to the organs of respiration, and it has sometimes been called chronic croup; but it is very different from croup, and is altogether of a convulsive character, *arising from the same causes*, and is relieved by the same remedies as other convulsive affections." Again he remarks, "It rarely happens that a child recovers from an attack of this sort, unless the progress of the disorder has been interrupted by a timely application of proper remedies, without a general convulsion." Again, "Convulsions of this description seldom, if ever, occur after the expiration of the third year of a child's life, and not often in children which have lived by sucking, till they have teeth, and have never taken animal food till the dentes cuspidati have come through the gums."

Such is the semeiology of the disease, which Kopp, Hirsch, and Montgomery ascribe exclusively to enlargement of the thymus; and Ley as confidently to hypertrophy of the cervical glands; and Marshall Hall, to irritation of the excito-motory system through the fifth pair of nerves in teething, the *pneumogastric* in indigestion, or the *spinal* nerves in constipation; and Cheyne and Clarke to cerebral congestion. This very difference of opinion, however, founded on difference of pathological appearances, proves very conclusively that the disease is not owing to a single cause, but occurs under a variety of circumstances giving rise to spasm of the glottis and respiratory muscles, and at length, often involving the whole nervous system. That such variety does occur in the morbid appearances in cases of death from this affection, will be obvious upon the most cursory examination. Thus Dr. Ley states that he has found "enlargement of the cervical glands all but universal in this disease," but he says nothing respecting enlargement of the thymus.* In two cases, Dr. Sweatman† "found nothing but a collection of small glandular swellings in the neck pressing upon the par vagum." Kopp and Hirsch found "the thymus enlarged in every case, but sound in structure; the lungs of a brown-red colour, highly congested; the heart soft, and the *foramen ovale open.*" Eche found "hypertrophy of the thymus, the brain and lungs normal, the heart healthy, with the exception of the right ventricle, which was soft and collapsed." Dr. Van Velsan, in one instance found the thymus "much enlarged, weighing about one ounce, and four inches in length." Rullman found "the brain congested, the larynx and air-tubes in a normal state, the thymus enlarged, but healthy, the lungs and right side of the heart filled with blood." Bruch and Pitscheft, have likewise found the thymus enlarged in this disease, but only in single cases. Pagenstecher found all the organs in the region of the neck, including the thymus, in a normal condition; indeed, this gland in one of his cases weighed but 102 grains. Marsh has observed similar appearances in two cases which he has recorded. Hood found enlarged thymus in seven children and two adults, who had died of asthma. Frank has alluded to hypertrophy of the thymus in this disease, but does not intimate that he ever saw a case. Caspari denies its existence. In the *Med. Chir. Notes and Illustrations*, part 1, Mr. Fletcher has recorded several very interesting cases of "spasm of the glottis," from various causes. We have already referred to several cases published in this country, where the thymus gland was supposed to have been enlarged in this affection.

Kopp's Cases of Thymic Asthma.

	Age.	Weight of Gland.
Case 1.	7 months,	more than one ounce.
" 2.	10 months,	not weighed.
" 3.	21 weeks,	not weighed.
" 4.	7 months,	not examined.
" 5.	10 months,	over one ounce.
" 6.	22 weeks,	one ounce.
" 7.	21 months.	large and granulated, not weighed.
" 8.	9 months,	recovered.

Remarks.—Five of these cases only, fell under Kopp's own observation, the others were communicated to him. In all, the children were teething, and the symptoms previous to the paroxyms were such as we meet with, in cases where the irritation from this cause is excessive. In only three of the cases was the thymus weighed; in one, it was granulated, and its texture otherwise altered, thus excluding it from genuine thymic asthma, as defined by Kopp himself. *In all, the foramen ovale was open.* Dr. Kopp has recorded four other cases communicated by his friends; in one of which the patient died sixty hours after birth, gland not weighed. In another, the subject was three years old, and the disease consisted in a scirrhous enlargement of the thymus. In two, the patients recovered; in one, aged seven months, the symptoms were entirely removed in nine days by antispasmodics, calomel and digitalis. As to some of these cases, we are told that "at the period of dentition, the attacks became more aggravated."

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* An essay on Laryngismus Stridulus. By Hugh Ley, London, 1836.

† Lectures on the Nervous System and its diseases. By Marshall Hall, p. 114.

Dr. Hirsch's Cases of Thymic Asthma.

	Age.	Weight of Thymus.
CASE 1.	10 months,	not examined.
" 2.	13 months,	9½ drachms—570 grains.
" 3.	13 months,	6 drachms, 6 grains—366 grains.
" 4.	9 months,	recovered.
" 5.	10 months,	recovered.

Remarks.—In all these cases the infants were also teething; four were male, and one female. Two died, and the thymus weighed in one case 570, and in the other 366 grains. Now, it will be seen, that if, as is stated by Meckel, Cooper, Horner, and other anatomists, the gland continues to grow to the end of the second year in the same proportion as the rest of the body, at the age of 13 months, at which death took place, the thymus, according to our calculation, which placed its weight at birth at only 229 grains, instead of 240, should have weighed 645 grains, instead of 570 and 366, there being a deficiency in the latter case of 279 grains from the normal weight. There is no evidence to show that in the other cases, the gland was enlarged at all. It is to be recollected, that Hirsch distinguishes thymic asthma from cases where the infant dies of suffocation, from the congenital development of the gland not allowing respiration, and also where the thymus presents a tuberculous, scirrhous, fatty, or other degeneration.

In the Essay of Dr. Montgomery, "On the sudden death of Children from Enlargement of the Thymus Gland," (*Dublin Journ. of Med. Sci. July*, 1836,) six cases are recorded. In the *first*, the infant died in convulsions at the age of nine months, induced by the irritation of teething. Gland not examined.—In the *second*, a child of about the same age had a paroxysm of a similar kind, brought on by an attempt to open the jaws to examine the gums; in which it died. Gland not examined.—In the *third*, an infant of five months perished in convulsions, to which it had been subject from the age of three months. "The thymus was found greatly enlarged; it was 3¼ inches long, 3 inches broad, and ¾ of an inch thick," and was supposed to weigh two ounces.—In the *fourth* case the child died in convulsions at the age of eight months. Gland not examined.—The *fifth* case was relieved in the course of a month by leeching over the sternum, blistering, and ointment of hydriodate of potash. The *sixth* recovered under a similar mode of treatment.

That spasm of the glottis is not always connected with enlargement of the cervical glands is admitted by Ley himself, although he states that he has generally met with such enlargement in his dissection of such cases. He attributes but little agency to the thymus, although Ryland remarks, in noticing Ley's theory, that the enlarged thymus may so obstruct the return of venous blood from the head, as to occasion apoplexy, and he thinks it probable that in some of the cases of Montgomery and Hirsch, death was produced in this manner. We however know that death from apoplexy is not thus sudden, or attended with the same symptoms, and that the thymus is altogether too spongy in its texture to produce compression to such a degree.

That the cervical glands are often enlarged in thymic asthma, we have no doubt; and we have as little doubt that it is a mere coincidence, and does not stand in the relation of cause and effect. In the first place, the disease occurs almost always in children of a scrofulous habit, in whom these glands are very generally enlarged; and we have seen that in a large majority of cases, it occurs during the period of dentition, when the irritation causes these glands to swell even in children not of a scrofulous habit. Although it does not fall within the design of the present essay to show that spasm of the glottis does not arise from enlarged cervical glands, yet we may remark that the objections of Marshall Hall to Ley's theory seem to us conclusive. They are, in substance, as follows:—1st. That pressure on the recurrent nerve would produce simple and continued paralysis, and would probably produce its effects gradually; whereas, this disease comes on suddenly and recedes suddenly, to return at intervals of days, weeks, or even months.—2d. The affection of the glottis often accompanies other affections indisputably spasmodic, as strabismus, carpo-pedal contractions, and general convulsions.—3d. If the disease arose from the pressure of enlarged glands it would be less curable, less variable, and less suddenly fatal; whereas, nearly all the recent cases are speedily relieved by attention to the teeth, stomach and bowels, or by tonics and change of air. This seems to show that irritation of the nerves of the glottis causing its closure, may be produced by the irritation of teething propagated through the fifth pair of nerves; by indigestion, through the pneumogastric; and perhaps the spinal, by constipation. That the cause, however, may exist in the nervous centres, as well as eccentrically from them, is highly probable, for M. Hall, in his lectures, relates the case of "croup-like convulsion," occurring occasionally in a little girl; until one day the bones of the cranium separated, and the convulsions ceased. In a case of spina bifida, also witnessed by him, there was a croup-like convulsion whenever the patient turned so as to press upon the tumour. Mr. Porter states, (*Lancet*, 1836-7,) "I have lately, with the assistance of Mr. Alcock, divided the recurrent nerves of several dogs, and am satisfied that however the operation may interfere with the voice of the animal, it has no immediate effect whatever on its respiration." Dr. Alhin of Berghin, describes a case of thymic asthma, where the cervical glands were found hardened and tuberculated; but the reviewer of Ryland on Diseases of the Larynx and Trachea, (*Lancet*, 1836,) remarks, "We possess more than one case of tubercular affection in children, where the pneumogastric has been completely flattened by the pressure of tubercles, without giving rise to any remarkable disturbance of the function of respiration."*

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* This subject is very ably discussed in Marshall Hall's "Fifth Lecture on the Nervous System," and in Ryland's "Treatise on the Diseases and Injuries of the Larynx and Trachea."—(Pp. 126-152.)

Dr. Roberts's Cases of Enlarged Thymus.—The cases which Dr. R. has published of enlargement of the thymus, are highly important, and deserve a careful review, as they are considered as going to establish the existence of a "new disease" entirely distinct from "thymic asthma" or the "croup-like convulsion of children," characterized chiefly by "extraordinarily rapid respiration, and extensive and forcible pulsation of the heart and great vessels." The symptoms of his first two cases, Dr. R. states, "differ from those of any case of enlarged thymus gland, recorded previously to that time." And again he remarks, "I do not doubt that the thymic asthma hitherto described depends on the condition of that organ, but it is evident that there is a second form of disease resulting from it, which Dr. Albers first predicted, which I first observed, and which will I think be found to be of frequent occurrence." At the close of his communication, however, Dr. R. having stated that in his dissections the gland had been easily detached from over the trachea, and no evidences had been found of very great compression, and that any great degree of compression would have been incompatible with the perfectly healthy condition of the lungs, concludes with the following very candid and just remark: "We are therefore, probably, as yet only imperfectly acquainted with the causes of thymic asthma, as hitherto described." If the same cause, enlarged thymus, can produce two distinct diseases, each characterized by a peculiar set of symptoms, it is highly important to know the fact; for if the success of our treatment does not depend on discriminating between the cases, still in a pathological point of view, the fact is one of rare interest and uncommon character.

Case I.—A coloured child, aged 8 months, while labouring under slight bronchitis, which had existed for several days, was exposed to the fumes of charcoal, which had been placed in a portable furnace, with hard coal, under a grate in a close room. It remained exposed to this gas from 9 A. M. to 2 P. M., when it was found "pale, cold, faint, and livid under the eyes, with froth upon its lips," &c.; Dr. R. states, that "the doors and windows of the room were closed, and that the smell of the coal gas was very offensive, even after the room had been for some time ventilated." Reaction came on, upon exposure to fresh air and the application of stimulants, when the following symptoms were developed: "skin hot and dry, pulse excessively frequent, respirations seventy per minute, *alæ nasi* in rapid play, a subscrepitous rattle heard all over the chest with every respiration: with every respiration a short groan was emitted; no cough; look anxious; eyes rolled upwards; opening at the fontanelle pulsating strongly; scalp greatly elevated with each respiration; heart beating so as to be felt on each side of the chest; aorta pulsating strongly in the abdomen." The child rubbed its head upon the pillow, tried to sit up, but as often fell back again. Believing it to be a case of "pneumonitis infantum," Dr. R. bled it, placed it in a warm bath, and gave antimonial wine to vomit, which only produced diaphoresis. Sinapisms and leeches were afterwards applied, and calomel, and pulv. antimonialis given; but the child grew cold, and expired with a slight spasm at 7 o'clock P. M. of the same day.

On dissection, the lungs were found perfectly healthy, not congested, universally crepitating; bronchi contained a little reddish froth, and some patches of arborescent redness; right side of the heart contained coagula of very black blood, superficial veins of brain filled with black blood. The *thymus* gland was found of "uncommon size," 3 inches in length, nearly ½ an inch thick, weighed 8 drachms, 4 grs.=484 grs. (*Am. Journ. Med. Scien.* xx. p. 384.) Brain and foramen ovale not examined. This abstract of the most important symptoms, may justly lead us to doubt whether this was a "peculiar disease," caused by enlargement of the thymus, or one of asphyxia from carbonic acid gas. It cannot be denied that the phenomena were such as we usually meet with in cases of the latter description, and such as we would, *a priori*, be led to expect. Admitting that the gland was enlarged, and even this is yet to be shown by further observations, is it not highly probable it was the consequence of the obstructed circulation, the effect, and not the cause of disease? Whether with Bichat, we explain the phenomena of asphyxia by the deleterious influence of venous or black blood upon the nervous system, and the muscular tissue to which it is sent;—or with Dr. Kay, by the stagnation of blood in the lungs, from the impossibility of non-arterialized blood entering the minute pulmonary capillaries, thus depriving the left side of the heart of its appropriate stimulus, by cutting off its supply of oxygenated blood, yet, on either hypothesis, we believe it can satisfactorily be shown, that congestion of the thymus would necessarily result. If the right side of the heart is not able to free itself of blood, from obstruction of the capillaries of the pulmonary arteries, the superior vena cava will remain unemptied of its contents, and the venous tide sets back, obstructing the entrance from the vena innominata, the mammary and thyroid veins, which convey the blood from the thymus, and congestion of the gland necessarily follows; we have seen this strikingly exhibited in the case of an infant, which met its death from submersion in water, soon after birth. The thymus was enlarged to a very remarkable degree, weighing, as we judged, fully an ounce; and on cutting one of its veins, the blood flowed out in a large quantity, and continued to flow for a considerable time, showing that the gland was highly congested. Moreover, Dr. R. states, that "the right side of the heart contained coagula of very black blood." In cases of death from asphyxia, Dr. Copeland states, that "right cavities of the heart, the vena cava, and other large veins are engorged with black, and semi-coagulated or fluid blood." Again, as the venous coats are now admitted to possess a certain degree of contractile power; if this power be paralyzed by the contact of blood, possessing less than its usual degree of oxygenation, then congestion would be the result. The "elevation of brain during expiration," noticed by Dr. R. is a prominent symptom of asphyxia, where the fontanelle remains open, and is fully explained by the obstruction of the circulation in the lungs above noticed. If we admit that death did occur in this case from enlargement of the thymus, then the question recurs, why did not some unusual symptoms appear at an earlier period? The "phthisicky" symptoms, referred to, can hardly be regarded in this light, as there are few infants who do not at times manifest such, especially if "liable to colds." The freedom from such attacks previously, does not lend much support to the opinion that the enlargement was "congenital."

Case II.—The second case of Dr. R. was that of an infant, which survived but 13 hours after birth. The only morbid symptoms were rapid respiration, violent pulsation of the heart and arteries, and frequent pulse. The thymus weighed 402 grains; but whether this abnormal weight is to be regarded in the light of cause or effect, cannot satisfactorily be made out from the short history of the case. (*Amer. Journ. Med. Scien.* xxiii, p. 255.) The brain was not examined, but the heart and lungs are stated to have been in a healthy condition.

Case III.—This occurred in a female mulatto child, aged 8 months, of delicate appearance. Had laboured under bronchitis for a day or two; when first seen had considerable fever; pulse 170 per minute; respiration 60; respiration bronchial, some sonorous rhoncus; eight hours after, fine muco-crepitant rattle was heard in the trachea; completely indifferent to surrounding objects, uttered a faint moan occasionally; mouth constantly open; action of the heart not excessive; died the next morning. On dissection, the bronchi were found *reddened* and *decidedly congested* in their smaller ramifications; the substance of lungs healthy and crepitating. "The enlarged thymus gland extended by two long cornua lying parallel upon the trachea, from the base of the thyroid gland to the sternum, whence the enlarged body of the gland reached to the level of the fifth rib. Each lobe passed down below the edge of the lung of its own side; the left being much the largest, dipping down so as to cover the left side of the heart superiorly and completely, and the front for at least half of its extent, was also overlaid." *Thymus* weighed 330 grains; length 3¼ inches, breadth 2¼ inches. (*New York Journ. of Med. and Surg.* ii, p. 145.)

Remarks.—This child, it seems, died of bronchitis with head affection, if symptoms and pathological appearances prove anything. There was besides, none of that extremely hurried respiration, and violent action of the heart and great vessels, noticed in the former cases, and which was called *diagnostic* of the affection. The size of the gland, moreover, does not strike us as at all remarkable, or any more than the probable average weight at that age; we have no doubt whatever, if Dr. R. will weigh the thymus, where the patient at the same age, has died of unequivocal pneumonia, he will find it weighing as much, if not even more, than in the present instance. Dr. R. commenting on this case remarks: "The gland in this was much smaller than in either of the other cases, and remarkable for the length of the cornua which lay along the trachea, from the sternum to the base of the thyroid gland, loosely connected to it by cellular tissue, and easily dissected off. If pressure on the nervi vagi by the cornua were the cause of the symptoms, they should in this case have been marked by peculiar severity. But such was not the case. The extremely rapid breathing which characterized both the other cases, the violent pulsations of the heart which existed in them both, were absent or unobserved. The extreme frequency of pulse there mentioned was not present; yet the heart was quite as much enveloped by the glands, as in my second case." If then, this be a true case of disease from enlarged thymus, the diagnostic previously given, viz. "the sudden invasion of extraordinarily rapid respiration and extensive and forcible pulsation of the heart" must be abandoned. The fact is, that in no two of the three cases do the symptoms coincide, with the exception of rapid pulse and hurried breathing in the two first; and these are too common in infants, and occasioned by so many causes, that they cannot be viewed as diagnostic of anything in particular. It is impossible to appreciate the value of morbid changes in the lungs of infants with sufficient accuracy as to warrant us in saying, that in any given case, they were not sufficient to have occasioned death in a certain time; neither do we believe that auscultation or percussion is of any value in detecting the size of the thymus gland. This case, however, possesses a degree of negative value, as going to show that great length of the thymus, covering nearly the whole surface of the heart, does not materially disturb its functions; and that pressure of the gland on the par vagum, does not occasion the croup-like convulsion.

Case IV.—This case occurred in an infant 19 months and 7 days old, who had laboured almost from birth under repeated paroxysms of true thymic asthma. When only a week old, she one day gave a convulsive start, seemed to be choking, and to be quite gone. In a short time she gasped and recovered, but continued to strangle for half an hour afterwards. A few days after had a similar attack; deliquium complete; at 4 months again attacked by the strangling; eyes seemed starting from her head; frequently had turns of shortness and catching of breath; from birth, could never lie on her stomach, owing to its effect on her breath; had a habit of keeping her mouth open a good deal; frequently retched, as if worms were ascending to the throat; had never walked; creeping fast put her out of breath, and made her strangle; laughing nearly killed her, put her in pain and caused her to hiccup; when she had a little cold had more strangling than at other times; one of these paroxysms was followed by fever, rapid respiration and pulse, anxious looks, &c., which terminated fatally the next day. The parents lost three other children, apparently of the same affection; one aged

14 months, one 19 months, and another 7 weeks. On dissection, the bronchial tubes were found considerably inflamed, and trifling pneumonia existed in the lower portion of one lung. The bronchial glands were enlarged and congested. The thymus much hypertrophied, preserving its natural colour, consistence, and texture; its length 3½ inches; breadth 2 inches; greatest thickness ½ inch; not weighed;—it covered the great vessels, and about half the surface of the heart. The *heart* was considerably enlarged, principally by hypertrophy of the left ventricle; the right auricle contained an old polypus of considerable size; *foramen ovale* not examined.

Remarks.—Those who have witnessed cases of *morbus cyanosus*, or *cynopathia*, will, we believe, have little difficulty in identifying it with the above. Thus, Stewart (*Diseases of Children*, p. 119) remarks, "when a young infant is affected with this disease, the respiration is at intervals very laborious and distressing; sometimes accompanied with loud screams. In a few minutes the respiration is entirely suspended, the eyes are vacant, the hue of the face changes, &c. While in this condition, the child suddenly screams, is convulsed, and with two or three sudden inspirations the circulation is again restored. When the child has arrived at the age at which he commences the use of his limbs in walking, the increase of circulation from this cause embarrasses the heart in its action, and repeated fainting fits are the result," &c.* It is now well known, that an open state of the foramen ovale, does not necessarily, or even in a majority of cases, produce the cerulean hue of the skin; but the disease is sufficiently indicated by other symptoms.

The polypus in the right ventricle may have had some influence in hastening the fatal result; but the chief difficulty, we have no doubt, was the patulous state of the inter-auricular foramen.

Case V.—In this instance the thymus weighed but 175 grains, 65 less than the normal weight at birth, although the child was 19 months old. We cannot conceive it possible that a gland of this size could occasion any serious symptoms.

Case VI.—In this case the child died at the age of 2 years 8 months, of scarlatina, with congestion of the brain. The skin "was burning hot, and red as scarlet;" the "child very feverish and drowsy"—"face had a mottled, purplish look," &c.; was sick but two days. The lungs were found healthy, the left ventricle of the heart hypertrophied, and the heart itself larger than natural. The thymus entirely covered the heart, and weighed 257 grains; 17 more than the normal weight at birth.

Besides these, there have been four other cases reported in our medical journals, as enlarged thymus. In one, reported by Dr. Hoffman, (*New York Med. Gaz.* vol. i, No. 2,) the gland weighed but 330 grains, at the age of 10 months. In this case, the patient was first visited on Friday, the parents having sent for the physician to "cut the gums," from her restlessness through the night. There were no symptoms observed but "unnatural fretfulness." The next day, the breathing became very rapid, the "*alæ nasi* and head moving with each inspiration." As there were no other morbid symptoms present, the Dr. naively remarks, that not knowing "what else to make of the case, he *diagnosed it as enlargement of the thymus*." On Sunday, Dr. Moore found the patient "breathing with great difficulty, coughing frequently, and occasionally straining to vomit." The difficulty of breathing rapidly increased, and death occurred on the same day at 2 P. M. No morbid appearances were observed, with the exception (?) of the size of the thymus, above noticed.

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* For a case of cyanosus in an adult, accompanied by symptoms similar to those decribed in the case of Dr. R., see American Journ. Med. Sciences, vol. ii, p. 422.

In a case contained in the same number of the *Gazette*, and extracted from *Guy's Hospital Reports*, a child 4 months old, always more or less subject to dyspnœa and cough, began to breathe with difficulty, and coma soon set in, and the child soon died. The left lung was found considerably inflamed; the right auricle of the heart was dilated; both ventricles hypertrophied; *foramen ovale* open. Thymus much enlarged; weight not given. A clear case of cyanosis.

In a case communicated by Dr. Hamilton of Rochester to Dr. Roberts, and published in the second No. of the *N. Y. Med. Gazette*, a child of nine months, who had previovsly enjoyed good health, although "his complexion had partaken a little of the blue tint," was exposed to measles, soon after which he had a slight cough, preceded by asthmatic symptoms. In a short time the respiration became extremely hurried, and the pulse rapid, "at times, more so than at others." The child grew more pale, extremities cold, clammy, breathing more hurried, 93 inspirations in a minute, pulse not perceptible, action of heart very rapid, chest and shoulders elevated at each inspiration, mouth kept slightly open and nostrils moderately dilated.

Thymus gland 3⅜ inches long, 3 inches broad, ½ inch thick; weight ℥i=480 grains. The phrenic nerves passed through its substance. The heart was distended, and the coronary vessels highly injected; the ventricles contained coagula and some fluid blood. The large venous and arterial trunks contained uncoagulated dark blood. The *foramen ovale was open to four lines in diameter*, the valve being imperfect; evidences of slight bronchitis.

After having read the very judicious remarks of Dr. H. in relation to this case, we are surprised to find him regarding it as a variety of "thymic asthma," when it would seem to be as clear a case of cyanosis, even to the "blue tint," as was ever recorded. We are much mistaken, if most pathologists would not consider the condition of the heart a sufficient cause of death, without taking into view the exact size and weight of the thymus gland. We deem it unnecessary to quote any other cases of supposed enlarged thymus in order to form an opinion as to the influence of this cause in the production of the symptoms attributed to it. We have seen asphyxia, spasmodic croup, cyanosis, pneumonia, and bronchitis, all attributed to hypertrophy of this organ, and so various were the symptoms in different cases, that the advocates of this theory have been driven to the necessity of forming distinct varieties of the disease, according as the gland pressed upon the lungs, or the heart and great vessels, when its situation seems nearly uniformly to have been the same. Dissections show that the thymus, when enlarged, does not encroach materially upon the trachea or the lungs, but rather upon the heart, as stated by Dr. Roberts. We have noticed in several instances, where the gland seemed enlarged, that, as Albers states, "the lower portion rested upon the pericardium, just where lie the auricle and a portion of the right ventricle, and the large vascular trunk of the heart;" but so compressible and spongy was its texture, that we could not believe it capable of occasioning any serious symptoms. There is therefore much truth in the remark of Albers, that "if morbid symptoms are produced by the pressure and irritation which the thymus creates in the neighbouring parts, it is the circulation rather than the respiration which is to be interfered with; the symptoms consequently should refer to the functions of the first rather than the second, and the chief will be disorder in the functions of the vascular system." We do not admit, however, that there is any evidence to show that hypertrophy of the thymus simply, without any condensation or change of structure, does cause disorder, either in the vascular or respiratory system. Dr. Mott assures us, that in the case of enlarged thymus, already referred to as having fallen under his treatment, although the gland was enormously enlarged, it produced no obstruction in the respiration or interfered in the least with the regular and normal action of the heart. M. Billard, whose autopsic examinations of children have been perhaps more numerous than those of any other writer, remarks, "the thymus gland is susceptible of being affected with certain diseases, during the short space of its transient existence. I have never been able to observe any peculiar symptoms belonging to these affections; but on opening the bodies of children, I have seen it, in two instances, much tumefied, very red and extremely friable. I considered it as the result of an inflammation, which perhaps might lead to its suppuration or disorganization." The thymus, moreover, varies extremely in different subjects—from 50 grains at the period of birth up to ℥i or 480 grains, or even more. This difference of weight and size also holds at different ages. Dr. Roberts has published cases varying from 80 to 360 grains, in still-born children. We have known one weigh 400 at the same period. It seems to us highly probable, and we believe further observation will confirm the correctness of the opinion, that where the circulation through the lungs is obstructed from any cause the thymus will be found congested, or in a state of abnormal enlargement. Hence the reason of its apparent hypertrophy, where the foramen ovale has remained open, or where the patient has perished of pneumonia. We have seen that in all of Kopp's cases of "Thymic Asthma," in Dr. Hamilton's, and in nearly all where the thymus has been found greatly enlarged, the foramen ovale when examined has been open. This fact has been noticed by Meckel. "Its continuance (the thymus) at the degree of development which characterizes it in the early periods of life, sometimes attends abnormal formations of the heart, and those states of the lungs which prevent the perfect formation of the blood." (*Anat.* vol. ii.) In most of the cases of cyanosis, terminating fatally, we have seen that they have been complicated with pneumonia or slight bronchitis, not apparently sufficient of itself to have caused death, and we are led to inquire into the cause of the fatal result. Now, when the other functions of the body are in a healthy condition, and the body in comparatively a state of rest, the contractile power of both ventricles is nearly equal in relation to the resistence to be overcome, and as their action is synchronous, no admixture of the venous and arterial, or black and red blood takes place; unless indeed, the natural openings of the cavities are obstructed. But if the lungs become congested from inflammation, requiring greater contractile powers in the right ventricle to force the blood through the pulmonary circulation, the balance between the two is lost, and the blood is forced through the foramen ovale into the left auricle, where it is mixed with arterial blood and distributed throughout the body. But the surcharged state of the heart occasions a paroxysm of tumultuous palpitation, panting, and hurried respiration, and perhaps deliquium, in one of which the patient either dies, or is worn out by protracted suffering and anguish. The same symptoms occur, when an increased quantity of blood is thrown into the heart by exercise. The thymus, whose function we have seen closely connected with fœtal nourishment in the absence of proper chylification, is again stimulated to the discharge of its former office in the absence of hæmatosis, without which chylification itself languishes, or nearly ceases. It is not strange, therefore, that it should become hypertrophied in cases where the foramen ovale remains open, or where there is any unusual obstruction to the pulmonary circulation. The above explanation will enable us to understand why a slight attack of pneumonia causes a paroxysm of cyanosis to prove fatal; but we see no satisfactory reason why such complication should give fatality to simple enlargement of the thymus gland. We, indeed, know that life may be, and often is maintained by one lung alone, and even a portion of one; how improbable then that the slight compression, if even such there be, exerted by the thymus in cases of its greatest enlargement should lead to a fatal termination. Besides, how often do we see the *thyroid* gland enlarged to most enormous dimensions, pressing not only upon the trachea, but upon the large vessels in the neck and upon the par vagum, recurrent and sympathetic nerves, without producing any disorder in the functions of respiration and circulation.

The conclusions, then, to which we arrive, after a full and we trust impartial survey of the whole subject, are as follows:—

1. That "thymic asthma" and "spasm of the glottis" are the same disease, which often owes its origin to irritation of the nerves of the glottis, sometimes involving the whole excito-motory system, chiefly by teething, through the fifth pair of nerves; occasionally perhaps to enlarged cervical glands, but very seldom if ever to a similar condition of the thymus.

2. That many other affections have been mistaken for thymic asthma, especially asphyxia, cyanosis, bronchitis, pneumonia, scarlatina, &c.; and that the cases which have been brought forward to sustain the belief in the existence of a *new disease* depending on hypertrophy of the thymus, are of an equivocal and unsatisfactory character.

3. In a large majority of cases, where we have reason to believe the thymus was of an abnormal weight, such enlargement is to be considered in the light of an effect and not a cause, of the morbid symptoms.

4. In most of the cases which have been latterly adduced to support the theory of the thymic origin of the croup-like convulsion, there is no satisfactory proof that the thymus was enlarged: in some it was below the normal standard; in many its weight was unascertained.

5. In many instances, the thymus gland has been found enlarged, without having produced any of the symptoms of thymic asthma, or of what has been called the "new disease;" and, on the contrary, the symptoms have existed without any enlargement of the thymus.

6. The weight and size of the thymus vary so materially in different subjects, and so little is known of its rate of increase during the first two years of life, that no standard can, at present, be laid down with sufficient accuracy, to warrant us in asserting that a deviation of a few grains more or less, exceeds or falls short of the normal weight at a given period.

7. It follows, lastly, that numerous additional observations of the weight and size of the gland, both in health and disease, are required, before we can form any well-founded and definite opinion as to its agency in the production of morbid phenomena.